

SIKKIM

GOVERNMENT



GAZETTE

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**GOVERNMENT OF SIKKIM
HOME DEPARTMENT
GANGTOK**

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NOTIFICATION

Whereas, the State Government has deemed it expedient to make the following guidelines to facilitate general public awareness for safeguarding the public safety and property from potential damages, hazards and threats arising out of construction and maintenance of hydro projects.

And whereas, the purpose of guidelines is to describe the types of hazards that can exist at hydro power facilities and the safety devices and others measures that are advisable to be employed to enhance the protection of the public that utilize projects lands and water.

Now therefore, the State Government, with a view to achieve the above objectives, is hereby pleased to prescribe the GUIDELINES FOR PUBLIC SAFETY AT HYDROPOWER PROJECTS as per Annexure.

By Order and in the name of the Governor.

**(R. Ongmu) IAS,
CHIEF SECRETARY
F. No. Home/Confdl/112/2015**

GUIDELINES FOR PUBLIC SAFETY AT HYDROPOWER PROJECTS

1. INTRODUCTION

The safety of public life and properties are the prime responsibility of the Government. The implementation of the law being the mandate of the State and District Administration, these guidelines should be viewed in conjunction with any notifications issued by the Administration from time to time, whenever felt necessary in the interest of the safety of life and property. The Developer is fully responsible for safeguarding the public and property from any potential damages, hazards and threats arising out of construction, operation and maintenance of the Hydro power Projects.

Conditions may exist at or near hydropower facilities that could be dangerous or conducive to accidents that could cause injury or loss of life and properties. The potential for drowning, accidental deaths and injuries near Project facilities and on other Project lands and waters has been of concern for a considerable time. The Government is primarily concerned with the hazards created by Project structures and operations.

The purpose of this document is to describe the types of hazards that can exist at hydropower facilities and the safety devices or other measures that are advised to be employed to enhance the protection of the public that utilize Project lands and waters. Project Developers are solely responsible for providing any appropriate safety devices and other safety measures at their Projects, even if not specifically required by the District Administration. However, the District Administration in cooperation with the implementing department and the Project Developers, are expected to assess the overall need for safety devices or other safety measures at all Projects in order to develop the most effective solution to identify safety problems. Project Developers are expected to expeditiously install and properly maintain any safety measures they determine are needed or are required. This document provides general guidelines and criteria on safety devices because each Project is unique and will necessarily require judgements and solutions that should be made in the field. The District Administration should issue instructions requiring Developers of hydro Projects under its jurisdiction to operate and properly maintain such Projects for the protection of life, health, and property.

To the satisfaction of, and within a time specified by the District Administration, the Developer must install, operate, and maintain all signs, lights, sirens, barriers, or other safety devices that may reasonably be necessary or desirable to warn the public of fluctuations in

outflow from the Project or otherwise to protect the public in the use of the Project lands and waters.

2. HAZARDOUS FEATURES AT PROJECTS

- I. RESERVOIR AREAS
- II. SPILLWAYS
- III. POWERHOUSE INTAKES
- IV. POWERHOUSE TAILRACE AREAS
- V. SPILLWAY TAILRACES AND TAILWATER AREAS.
- VI. CANALS
- VII. INTAKE AREAS
- VIII. BOAT RAMPS
- IX. SURGE SHAFT AREAS
- X. VICINITY OF SUBSTATIONS AND TRANSMISSION POWERLINES
- XI. BRIDGES
- XII. PROJECT STRUCTURES
- XIII. NATURAL AND OTHER HAZARDS
- XIV. RECREATION AREAS
- XV. WINTER CONDITIONS
- XVI. HIGHLY POPULATED AREAS

3. OPERATIONS AND OTHER FACTORS AFFECTING PUBLIC SAFETY

Many hazardous aspects of Projects are not present at all times and they may not be readily observed during a brief inspection of the Project. Therefore, it is important to consider the full range of spillway and plant operations that could cause hazardous conditions. Peaking operations are more hazardous than run-of-river operations, since tail waters are normally calm and low flows occur between periods of generation. When generation begins especially during peaking the tail waters rise rapidly and become swift and hazardous in a very short time. It is particularly important to determine that a Project described as run-of-river is actually operated continuously and that it does not have frequent generation/peaking cycles. Some plants with small reservoirs that are located downstream of larger peaking plants cannot store water and are considered "run-of-river" plants. Tailrace areas are particularly dangerous when spillway gates are opened quickly and without warning, discharging flows into dry or calm areas below spillways.

Low head and small diversion dams can be especially hazardous due to the indifference with which the public views them. Very dangerous reverse or "keeper" flows are often created on the downstream side of small overflow dams, and even those with as little as two feet of head can be very dangerous. Therefore, most dams should have some sort of safety protection regardless of the size of the dam and reservoir. It is possible that, at times, several factors could simultaneously occur at a Project, making otherwise safe areas dangerous. Therefore, it is necessary that consideration be given to these and other factors when analyzing the hazardous aspects and determining the safety needs of a Project.

4. SAFETY DEVICES AND MEASURES

As a general rule, all Projects will require some type of safety devices, warning systems or other measures. The amount of protection necessary increases as public exposure to the hazards increases.

Safety devices and measures can be divided into five basic categories:

- (1) Educating and informing the public***
- (2) Visual and audible warnings of hazardous areas***
- (3) Physical restraining devices***
- (4) Escape devices***
- (5) Procedures for safer Project operations.***

5 (1) EDUCATION AND INFORMATION - Developers are usually well aware of the hazards that can exist near hydropower Projects. Therefore, the Developer has a responsibility to take the initiative to educate and inform the public of the specific hazards near its hydro Projects and of the general rules that should be followed to be safety conscious. Where appropriate, information could be disseminated in recreational brochures, company literature, video tapes, television or radio announcements and in newspaper articles and advertisements. The Developer should make every effort to meet with the public at schools, civic organizations, etc., communicate with the public through the media, and distribute literature on water safety practices in the vicinity of the Hydro Project areas.

(2) WARNING DEVICES - Warning devices include such items as danger and warning signs, canoe/rafting portage signs, audible warning devices, lights and illumination, beacons and strobe lights, buoys, and verbal warnings. These devices are required where necessary to warn of hazardous spillways, powerhouse intake areas, tailraces, and other hazardous areas and conditions.

(i) Danger and Warning Signs - Each dam should have adequate danger and warning signs. Properly located and spaced signs can be an effective method of preventing persons from entering hazardous areas. It is important to locate signs so that persons entering an area from any direction can see one or more of the signs. Where it is not feasible to install boat restraining barriers due to the length of the dam or spillway, or other constraints, a system of warning buoys and signs should be installed at least 300 feet from the structures or at a greater distance, depending on where the hazardous current begins. If the Project reservoir is small, as a practical matter it may be necessary to place the buoys and signs closer to the dam. The size of lettering and the signs themselves should be of sufficient size that persons (even those with less than perfect eyesight) would not have to enter the danger zone to read the signs. As a general rule, when a person is 300 feet from any dam, signs warning of a dam should be legible and easily noticed. Proper wording of signs is important and can improve effectiveness. Signs should convey a message that clearly advises the reader of the real danger. In addition to "No Trespassing" or "Keep Out" signs, it would be informative to have signs that state: "Danger - Dam Ahead", "Danger of Drowning", or "Stay Alive by Staying Out". Signs should be kept in good condition and fading signs should be repainted. Plants, grasses, and trees that obstruct shoreline warning signs should be removed. Contrasting colors should be used for sign lettering and background. A regular sign inspection programme should be developed and documented to ensure that all signs are maintained in good condition. It is particularly important to inspect signs after severe weather or flood conditions.

(ii) Power and Communication Lines - Power and communication lines require special signing to warn recreationists of clearance heights. Minimum recommended vertical clearances for power and communication lines over reservoirs are found in the standard codes and regulations.

(iii) Audible Devices - Audible devices, such as sirens, horns, or buzzers, are generally used to warn of sudden changes in the rate of flow, usually in tail water areas of spillways or powerhouses. It is also important to provide warnings of sudden changes in operation, such as a gate opening to pass flows that have been cut-off due to a plant shutdown. At Projects where difficult terrain prevents a quick exit from the river, advance warning of 30 to 45 minutes may be necessary. Signs advising of the meaning of the audible devices should be posted along all access points near hazardous tail water and other areas. At least one adequately big siren should be installed at every 1-2 km along the entire river bed within the Project area and the

area downstream that comes within the Project. All these sirens should be operated through GSM with adequate power backup so that they could be blown from one central location itself and also in case of power failure.

(iv) Lights - Lights should be used to illuminate signs, the dam itself, and other hazardous areas. It is desirable that at least some of the warning signs around dams be illuminated at night. Lighting should be considered at dams, tailrace areas, substations. Specially designed signs, safety devices, including lighting may often be necessary so that safety devices are effective under adverse weather conditions.

(v) Beacons - Beacons and strobe lights can be utilized near spillway gates and overflow spillways and, if appropriate, they should be activated to provide visual warning when water is being discharged. Flashing strobe lights can also effectively complement audible warning devices.

(vi) Buoys - Individually anchored buoys basically serve as floating signs. In general, buoys should be installed in accordance with accepted rules and regulations in the State where the Project is located. Buoys may not be appropriate in low-use areas in many cases or in areas where the pristine nature of the area should be preserved. However, buoys should not be substituted for restraining barriers where a positive restraining barrier is feasible.

(vii) Verbal Announcements - Recorded or direct verbal warnings can be used at many smaller Projects to warn the public in tailrace areas that gates are going to be opened if the Project is always manned. However, this can only be effective if dam tenders and other personnel working near dams are adequately trained to advise the public of a Project's hazardous areas.

(3) RESTRAINING DEVICES - Restraining devices include restraining barriers, fences, guardrails, natural barriers, trash racks, debris deflector booms, and other similar devices.

(i) Boat Barriers - Boat restraining barriers as well as warning devices should be provided at those Projects where rafts, boats and canoes are exposed to hazardous spillways, tailrace areas or intake areas.

(ii). Fences - Fences and guardrails are required at most Projects to prevent public access to hazardous areas such as dams, powerhouses, substations, intake areas, wing walls, highly populated areas, etc. Fences together with signs and locked gates are probably the most effective means of prohibiting land based access to hazardous Project features.

(iii) Trash racks - Trash racks are located upstream of most powerhouse intake structures and occasionally in other areas. They are primarily installed for the purpose of catching debris. It is not desirable for the public to have access to trashrack areas because they are dangerous, particularly where there is high velocity flow. Trashracks do prevent those who have fallen in the water from being drawn into turbines, penstocks, siphons, or other enclosed water passages. As such, they serve as last chance safety devices. However, adequate safety devices and warning signs should be the first line of protection because the probability of survival if someone is caught by a trash rack is doubtful.

(v) Guards - Uniformed guards and watchmen should be employed and deployed in some heavily used public areas to enforce regulations and warning signs and minimize trespassing and vandalism.

(4) ESCAPE DEVICES - Escape devices include such items as life preservers, safety ropes, escape nets, escape ladders and suspended cables. These items provide a means of escape for persons who are otherwise unable to get out of hazardous waters.

(i) Life Preservers - It is desirable that life rings and safety ropes be provided near dams, powerhouses, and canals, etc., where it is likely that someone would be available to use them to aid a victim. These devices should be in readily accessible locations and well identified.

(ii) Escape Ladders - When Project waters flow through open but confined channels, such as lined canals and concrete lined intake and tailrace areas, self escape devices such as ladders may be considered.

(iii) Safety Nets - When canals terminate at hazardous structures such as siphon inlets, powerhouse and penstock inlets, or spillways, etc., safety cables, booms, or safety nets are often necessary for a victim to grab when caught in midstream.

(iv) Raft/Canoe/Kayak Portages - Designated canoe/kayak portages serve not only as recreational facilities, but also as safety facilities. Where necessary there should be landing and portage areas around dams or other structures. If adequately signed portages are not located in safe areas, boaters can unknowingly enter hazardous areas and dangerous situations. Portage signs large enough to direct them to safe take-out sites are necessary at all Projects that have even occasional rafting, canoeing or kayaking use. As a general rule, canoe/kayak portages should not be within 300 feet of any dam, spillway, or powerhouse.

(5) PROJECT OPERATING PROCEDURES - In certain situations, changing Project operating procedures can improve safety conditions at a Project. For instance, altering or imposing ramping rates for generating units can prevent sudden increases in tail water levels. Modifying gate opening procedures may reduce or eliminate sudden surges in flows or may be used to direct flows to less hazardous areas. Each owner should be encouraged to review operating procedures as they affect public safety and to propose any necessary improvements, consistent with good public safety practices and the primary purposes of the Project.

6. BASIC PUBLIC SAFETY MEASURES

Each Project should be reviewed for public safety needs on a case-specific basis. It is extremely important to assess the number and type of public safety measures at any Project based on the public use patterns at a Project. Projects that do not have significant and documented recreational use may, for instance, require only nominal public safety measures such as proper signages. The following is a partial listing of public safety measures that should be considered when undertaking a case-by-case review of public safety at a Project:

- (1) Boat restraining barriers upstream of overflow, gated, flashboard (or rubber dam) and needle beam spillways, powerhouse and canal intake areas, and upstream of natural channels that extend to Project structures.
- (2) Warning signs in tailrace areas.
- (3) Clearly visible and legible warning signs at an appropriate distance upstream of and facing the reservoir of each dam and till the hazardous stretch downstream.
- (4) Fences at substations and restricted access to hazardous areas around dams and other Project structures. Fencing or barricading should also be provided in heavily populated areas and hazardous stretches.
- (5) Audible warning devices, together with signs to explain their meaning. Sirens should have a backup power in case of regular power failure and should be sounded well in advance and heard at regular intervals such that it is clearly audible all along the hazardous stretch downstream.
- (6) Restricted public access to powerhouses, intakes, and other operating structures.
- (7) Necessary signs facing the reservoir on each dam with a hazardous spillway, with lighting for night time visibility.
- (8) Signs posted at surge chambers to warn of sudden discharges.
- (9) Warning signs posted to warn boaters that may have to pass under low bridges.

- (10) Beacons at those Projects with heavy boating/rafting activity when spillway gates are open or being opened.
- (11) Trashracks in the intake areas of powerhouses.
- (12) Where safe installation can take place, escape devices installed at about 250 feet intervals in steep-sided or concrete lined canals.
- (13) Signs that warn of thin ice posted where Project operations cause hazardous thin ice conditions.
- (14) Power line clearances in accordance with appropriate codes.
- (15) Buoys to mark special hazards for boaters in Projects reservoirs such as shallow areas, stumps, rock, outcroppings, etc.
- (16) Spillways, intake areas, and tailrace areas should be sufficiently lit at night (i.e. perimeter lighting) to be recognizable from the shoreline and the reservoir, if appropriate. Because the operation of Projects may change and because the public use of many Projects continues to increase, the public safety aspects of each Project should be periodically evaluated by the Developer. Any changes should be brought to the attention of the District Administration.
- (17) The high flood water level downstream should be clearly marked and should be visible to the public within the vicinity of the river.
- (18) Emergency control room should be set up at each Project site and the emergency phone numbers should be properly advertised all along the hazardous length.
- (19) Trained search and rescue and medical team should be available in the Project area.
- (20) The Developer should submit to the District Administration and the Nodal Department the details of the Standard Operating Procedures (SOP), Emergency action plan, Inundation maps, Identified sensitive/dangerous zones, Warning and evacuation plans, Incident response, Early warning system. They have to follow all standard safety regulations as per the relevant Indian Standards Code, regulations and law.
- (21) All other safety measures as felt necessary by the District Administration in the interest of public life and safety of public properties.
- (22) In case of damages to the life and properties of public caused due carelessness/negligence or insufficient precautions or violation of specified guidelines by the Project during the construction, operation and maintenance of the Project, the Project Developer shall be liable for payment of compensation and criminal liability.

